



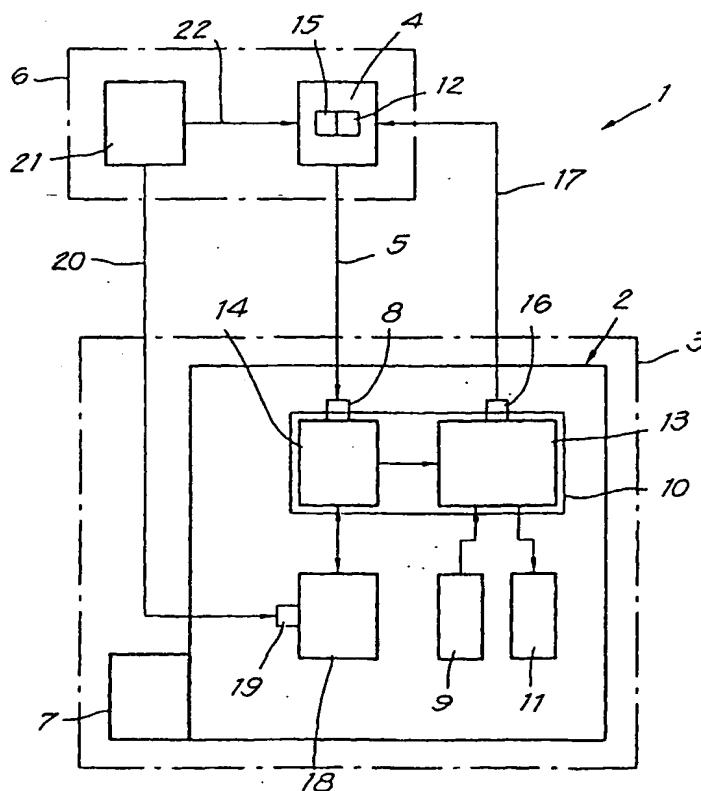
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>7</sup> :</b> <b>G08G 1/0968</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 00/46776</b> <b>(43) International Publication Date:</b> 10 August 2000 (10.08.00)
<b>(21) International Application Number:</b> PCT/BE00/00009 <b>(22) International Filing Date:</b> 25 January 2000 (25.01.00)  <b>(30) Priority Data:</b> 9900065                      2 February 1999 (02.02.99)                      BE  <b>(71) Applicant (for all designated States except US):</b> SMART-MOVE, NAAMLOZE VENNOOTSCHAP [BE/BE]; Van den Tymplestraat 33, B-3000 Leuven (BE).  <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> BUYTAERT, Steven, Herwig, Cyriel [BE/BE]; Eenmeilaan 199, B-3010 Kessel-Lo (BE).  <b>(74) Agent:</b> DONNE, Eddy; Bureau M.F.J. Bockstael nv, Arenbergstraat 13, B-2000 Antwerpen (BE).		<b>(81) Designated States:</b> AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

**(54) Title:** METHOD FOR MAKING NAVIGATION DATA AVAILABLE IN A VEHICLE AND NAVIGATION SYSTEM APPLYING THIS METHOD

**(57) Abstract**

Method for making navigation data available in a vehicle, in particular a road vehicle, whereby use is made of means (7) to determine the position of the vehicle (3) on the one hand, and whereby navigation data (5) are transmitted via a wireless connection to a telematics device (2) in the vehicle (3) on the other hand, characterised in that at least a number of navigational calculations are made in the telematics device (2) of the vehicle (3) itself, based on the navigation data (5) received via the wireless connection.



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Method for making navigation data available in a vehicle  
and navigation system applying this method.

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The present invention concerns a method for making navigation data available in a vehicle, in particular a road vehicle, as well as a device, in particular a navigation and/or telematics system applying the above-mentioned method.

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At present, mainly two types of navigation systems for road vehicles are known.

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The first type makes use of what is called an 'on-board' calculation system, whereby all the data are available on board of the vehicle and thus also all the calculations are made on board of the vehicle. All the data, i.e. all the road maps, are hereby situated on a carrier, usually a CD-ROM, in the vehicle. The calculations to determine the route to follow and to represent this on a display or such are all made inside the vehicle.

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The navigation system of this first type is disadvantageous in that the data on the CD-ROM are static and as a consequence become obsolete after a while. This implies that temporary changes in the traffic situation such as diversions and road works are not taken into account. Permanent changes, such as changed names of streets, hotels, restaurants and such, as well as newly laid roads are not taken into account either.

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Another disadvantage of such a navigation system is that it does not reckon in any way whatsoever with current traffic information. Thus, there is no interaction between the

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route description on the one hand and the current situation which practically influences this route on the other hand.

A second type of navigation system makes use of what is called an 'off-board' calculation system. This system makes use of a central 'server' in which current data are stored, by which are meant both current road maps and current traffic information. Upon request, the 'server' will send a precalculated route to the vehicle in a wireless manner, for example via GSM/SMS, whereby the position of the vehicle is taken into account.

This second type of navigation system is disadvantageous in that for every new calculation, for example when one deviates from the given route, one has to make a new connection with the 'server', and in that the available band width is too small to provide for a continuous connection with the vehicle and to deliver the required information in no time; further there is also the problem of the latency of SMS messages.

Up to now, use is always exclusively made of either an 'on-board' calculation system or an 'off-board' calculation system. Examples thereof are known from documents US 4.954.958, WO 96/11380, EP 0.803.852, US 5.543.789, FR 2.762.906 and WO 95/21435.

The invention aims a method for making navigation data available to a vehicle, as well as a new type of navigation system, whereby the above-mentioned disadvantages are excluded.

To this end, the invention in the first place aims a method for making navigation data available to a vehicle, in particular a road vehicle, whereby use is made of means to

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determine the position of the vehicle on the one hand, and whereby navigation data are transmitted via a wireless connection to a telematics device in the vehicle on the other hand, characterised in that at least a number of  
5    navigational calculations are made in the telematics device of the vehicle itself, based on the navigation data received via the wireless connection.

As the navigation data are received in a wireless manner,  
10    it is always possible to obtain current data, and the disadvantages of static data are excluded. As the transmitted navigation data also contain information which allows for a calculation in the vehicle, one does not have to call on the 'server' for every new calculation, as a  
15    result of which also the disadvantages of a conventional 'off-board' calculation are excluded.

According to a preferred embodiment of the method, at least the following steps will be provided for when determining a  
20    route:

- sending a request for a route to a desired location, via a wireless connection between the telematics device of the vehicle and a device of a data provider or 'server';
- 25    - determination of a precalculated route by the data provider;
- transmitting of the data of the precalculated route to the telematics device in the vehicle by the data provider and storage thereof in a memory in the  
30    telematics device;
- transmitting of contextual information related to the surrounding area of the precalculated route, also by the data provider, and storage thereof in a memory in the telematics device;

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- sending signals to the telematics device which enable the driver of the vehicle to follow the precalculated route;
- and, if desired or necessary, making additional  
5        navigational calculations on the basis of the stored contextual information by means of an algorithm.

This method is advantageous in that the precalculated route and the contextual information can be calculated in a short  
10       time by a powerful arithmetic unit, whereas a less powerful arithmetic unit in the telematics device of the vehicle will do to carry out most of the necessary recalculations in the vehicle itself, such that one does not have to call on the 'server' again for this.

15       The contextual information will be used for example to recalculate the route at the time the vehicle leaves the precalculated route.

20       Practically, a certain quantity of contextual information is preferably transmitted, and when this contextual information is insufficient for the calculation concerned in the telematics device of the vehicle, additional or new contextual information will be automatically received in a  
25       wireless manner as of the data supplier. This makes it possible to obtain an advantageous compromise between the quantity of transmitted contextual information on the one hand, and the chance of additional contextual information being necessary on the other hand.

30       According to another practical aspect, selected contextual information will be transmitted according to the invention, whereby it contains more details for those zones where the chance that the route will have to be recalculated is  
35       bigger than for the other zones. In particular, the

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contextual information preferably contains at least more details about the starting point and the end point of the precalculated route, as well as more details regarding busy traffic points, whereas it contains less details regarding the intermediate parts of the route. In this manner, the information package to be transmitted can be kept relatively small.

According to a variant of the invention, the calculation of the route to be followed can also be carried out entirely in the telematics device of the vehicle, whereby only navigation data are received from outside, hereafter also called 'contextual information', which make it possible to calculate the route, whereas precalculated routes are no longer transmitted. In this case, the method is thus characterised in that navigation data are generated which allow for a calculation of routes as a function of the position of the vehicle and/or the required final destination and/or the transmitting beacon used, in that these navigation data are transmitted to the vehicle and in that the route to be followed is calculated in the telematics device of the vehicle.

Hereby, the transmission of the navigation data, which in this case contain all the contextual information making it possible to make an entirely independent calculation of the route in the vehicle, can either take place following a request from a vehicle or automatically, either continuously or at certain intervals. The transmission can also take place at regular points in time, combined with the transmission following a request, in order to make it possible to also obtain information in between two points in time if necessary.

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According to a special embodiment, the method is characterised in that several transmitting beacons are used, each with a restricted range, but together covering an entire area, and in that navigation data are transmitted regarding the immediate surrounding area of every transmitting beacon concerned, containing many details regarding the immediate surrounding area of the transmitting beacon concerned, whereas less details are transmitted with relation to the broader area. In this manner, it is possible to always obtain the most relevant information in the vehicle. The information regarding the broader area enables the telematics device in the vehicle to determine what main roads should be taken. The information regarding the immediate vicinity makes it possible to accurately calculate and represent the route in the surrounding area of the vehicle. As the vehicle moves and comes within reach of another transmitting beacon, it will receive new information which is then relevant for the zone concerned in which the vehicle is situated, such that a detailed route for the immediate surrounding area of the vehicle can be calculated any time.

Both in the case where a precalculated route is transmitted via the wireless connection, together with contextual information, and in the case where only contextual information is transmitted without a precalculated route, the transmitted navigation data will preferably have the form of an algorithm.

Although the method also offers advantages when only the current road network is taken into account, also current information such as traffic information, weather information, etc. will preferably be taken into account.



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For practical reasons, the navigation data to be transmitted in a wireless manner, in particular the above-mentioned algorithm, will preferably be compressed. The same goes for the vector data used.

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The above-mentioned navigation data are preferably transmitted as a code which is executed in JAVA.

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It should be noted that, also in the case where navigation data are created as a function of a request and are subsequently transmitted to the applicant in the form of a precalculated route, accompanied by the necessary contextual information, this method can be combined with an automatic update as a function of the position of the

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vehicle.

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The invention also concerns a device for providing navigation data to a vehicle, in particular a road vehicle, applying the above-mentioned method, characterised in that it mainly consists of a device to among others provide navigation data in a wireless manner, whereby this device is equipped with means which can generate and transmit contextual information which makes it possible to make navigational calculations in the vehicle itself; a

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telematics device which is present in the vehicle itself having at least means for the wireless reception of the above-mentioned navigation data, means for putting in data so as to ask for a route, means for the processing of navigation data having an arithmetic unit for calculating a requested route on the basis of the above-mentioned

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contextual information, and means for representing the navigation data which are important to the driver; and means to determine the position of the vehicle working in conjunction with the telematics device.

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According to the most preferred embodiment, whereby not all the calculations regarding the route are carried out inside the vehicle, the device for providing the navigation data in a wireless manner is also equipped with means which can  
5 precalculate a route, whereby not only contextual information, but also a precalculated route together with contextual information is transmitted to the vehicle. The arithmetic unit in the telematics device of the vehicle carrying out calculations on the basis of the contextual  
10 information is then only activated when additional calculations, complementary to the route which has been precalculated off-board, have to be carried out.

In order to better explain the characteristics of the  
15 invention, the following preferred embodiments are described as an example only without being limitative in any way, with reference to the accompanying drawings, in which:

20 figure 1 represents a device according to the invention as a block diagram;  
figure 2 schematically illustrates another method according to the invention.

25 Figure 1 schematically represents a device 1 according to the invention, which consists of a telematics device 2 provided in a vehicle 3 on the one hand, and of a device 4 to provide navigation data 5 in a wireless manner, which is erected fixed, for example which is provided in a  
30 switchboard 6 and which is equipped with peripherals which are not represented, in particular transmitting and receiver units. Moreover, the device 1 also contains means 7 to determine the position of the vehicle 3, which means co-operate with the telematics device 2.

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The telematics device 2 contains means 8 for the wireless reception of the above-mentioned navigation data 5, means 9 to input data so as to apply for a route, means 10 for processing the navigation data 5 and means 11 to represent  
5 the navigation data which are important to the driver, for example in the form of a street plan upon which is indicated where the vehicle 3 is situated and what road should be followed, either or not combined with audio signals, represented on a display.

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The invention is special in that the device 4 is equipped with means 12, in particular calculation means, which can generate contextual information which makes it possible for  
at least a number of navigational calculations to be  
15 carried out in the vehicle 3, in particular in the means 10, on the basis of said contextual information.

Apart from the conventional module 13, the means 10 also contain an arithmetic unit 14 for carrying out navigational  
20 calculations regarding the route to be followed independently on the basis of the above-mentioned contextual information which is contained in the transmitted navigation data 5.

25 Although it is not excluded according to the invention that information is exclusively transmitted to the arithmetic unit 14, and that all route calculations are made in this arithmetic unit 14, a precalculated route is preferably determined in the device 4 which is transmitted to the  
30 telematics device 2 together with the contextual information. To this end, the device 4 consequently also contains means 15 which can calculate such a route beforehand as a function of a request signal 17 which is transmitted in a wireless manner via transmitting means 16.

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- 10 -

The telematics device 2 also contains a unit 18 for processing traffic information, working in conjunction with the arithmetic unit 14, such that the route can be recalculated at any moment as a function of the traffic situation. In this unit 18 is preferably built in a filter unit which exclusively transmits the relevant information to the above-mentioned arithmetic unit 14.

The unit 18 is equipped with reception means 19 which make it possible to receive information 20 from a data provider 21 of traffic information in a wireless manner. The latter also provides, as indicated by line 22, information to the device 4, such that when the precalculated route and the accompanying contextual information are generated, the most recent traffic information is taken into account as of that moment.

To sum up, we could say that the device 4 functions as a 'navigation server', the arithmetic unit 14 functions as a 'navigation agent', the means 18 function as a 'traffic agent' and the means 21 function as a 'traffic server'.

It should be noted that the different calculation means, units, etc., must not necessarily be made as separate parts. They may also be integrated as a whole in one or several electronic circuits.

It should also be noted that the wireless connections must not necessarily all follow separate channels, but that one and the same transmitter channel can be used to this end, for example via GSM.

The above-mentioned means 7 can be of any nature whatsoever. They preferably consist of a GPS (Global Positioning System). Naturally, also other systems can be

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used to determine the position of the vehicle 3, whereby use is made for example of fixed transmitting beacons, such as GSM masts, and of trigonometrical calculations, or whereby use is made of gyroscopes, direction detectors, speedometers, etc., or a combination of several of these possibilities.

The working of the device 1 is as follows.

10 When the navigation system is used, the driver of the vehicle 3 formulates a request for a specific route via the means 9, for example by putting in the destination. The point of departure is automatically known through the positioning of the vehicle 3 with the means 7.

15 The above-mentioned request is transmitted in a wireless manner to the device 4. In this device 4 is calculated a route by the means 15. The means 12 hereby generate relevant contextual information which preferably contains many details regarding the point of departure and the destination of the precalculated route, as well as busy traffic points, but which contains relatively few details regarding the intermediate parts of the route.

25 When determining the precalculated route and the contextual information, the most recent traffic information coming from the data supplier 21 is simultaneously taken into account.

30 This information is transmitted to the telematics device 2 in the form of navigation data 5 and it is stored in a memory. The precalculated route is appropriately transformed via the module 13 into a signal which can be supplied to the means 11, preferably on a display.

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Via the means 7, the position of the vehicle 3 is permanently calculated. The module 13 makes sure that a comparison is made in the known manner between the current position and the precalculated route. As soon as this  
5 route is deviated from, and a recalculation has to be made, use is made to this end according to the invention of the arithmetic unit 14 which makes it possible to make a recalculation on the basis of the contextual information which has been received beforehand without having to imply  
10 the device 4 again. Only in the case when the contextual information is insufficient, a request can be sent to the device 4 to transmit additional contextual information.

It is clear that, as the device 4 does not have to be  
15 implied for every calculation, the disadvantages mentioned in the introduction are excluded.

Via the unit 18, the contextual information in the arithmetic unit 14 can be adjusted as a function of the  
20 most recent traffic information. This traffic information can be asked for either regularly, or it can be received automatically and be updated every time new information is distributed in a wireless manner. The filter unit, which is integrated in the unit 18 as mentioned above, only  
25 retains information which is relevant.

As already mentioned in the introduction, the contextual information will not be formulated as a result of a request according to a variant, but it will be permanently  
30 distributed, whereby new information is automatically received by the telematics device 2 as a function of the range of transmission in which the vehicle 3 is situated. This is schematically represented in figure 2.

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When the vehicle 3 is situated within the range of transmission 23, it will receive contextual information from the mast 24, with many details regarding the zone 25 and few details regarding the larger zone 26. When a route calculation from A to B is required, the little information regarding zone 26 makes it possible to determine the main roads, whereas the detailed information regarding the zone 25 makes it possible to obtain information and to make a calculation regarding the immediate surrounding area of the vehicle 3.

As the vehicle 3 moves and enters another range of transmission 27, new detailed information regarding the zone 28 is received. In this manner, information is always available to determine a route in a sound manner.

The transmission ranges 23 and 27 may for example be transmission ranges of GSM masts, whereas the zones 25 and 28 practically coincide with them. The larger zone 26 may for example consist of a larger radius around one of the masts 24, or it may for example be the surface of a country or several countries.

The present invention is by no means limited to the above-described embodiments represented in the accompanying drawings; on the contrary, such a method and device can be made in all sorts of variants while still remaining within the scope of the invention.

Claims.

- 5 1. Method for making navigation data available in a vehicle, in particular a road vehicle, whereby use is made of means (7) to determine the position of the vehicle (3) on the one hand, and whereby navigation data (5) are transmitted via a wireless connection to a telematics  
10 device (2) in the vehicle (3) on the other hand, characterised in that at least a number of navigational calculations are made in the telematics device (2) of the vehicle (3) itself, based on the navigation data (5) received via the wireless connection.
- 15 2. Method according to claim 1, characterised in that, when determining a route, at least the following steps are provided for:
- sending a request for a route to a desired location, via  
20 a wireless connection between the telematics device (2) of the vehicle (3) and a device (4) of a data provider (21);
  - determination of a precalculated route by the data provider;
  - 25 - transmitting of the data of the precalculated route to the telematics device (2) in the vehicle (3) by the data provider and storage thereof in a memory in the telematics device (2);
  - transmitting of contextual information related to the  
30 surrounding area of the precalculated route, also by the data provider, and storage thereof in a memory in the telematics device (2);



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- sending signals to the telematics device (2) which enable the driver of the vehicle (3) to follow the precalculated route;
- and, if desired or necessary, making additional  
5      navigational calculations on the basis of the stored contextual information in the telematics device (2) itself.

3. Method according to claim 2, characterised in that the  
10      contextual information is used to recalculate the route on the moment when the vehicle (3) leaves the precalculated route.

4. Method according to claim 2 or 3, characterised in that  
15      a certain quantity of contextual information is transmitted, and when this contextual information is insufficient for the calculation concerned in the telematics device (2) of the vehicle (3), additional or new contextual information will be automatically received in a  
20      wireless manner.

5. Method according to claim 1, characterised in that navigation data (5), in particular contextual information, are generated which allow for a calculation of routes as a  
25      function of the position of the vehicle (3) and/or the final destination of the required route and/or the transmitting beacon used, in that these navigation data (5) are transmitted to the vehicle (3) and in that the route to be followed is calculated in the telematics device (2) of  
30      the vehicle (3).

6. Method according to claim 5, characterised in that the transmission takes place at regular points in time, either or not combined with transmissions following a request from  
35      the telematics device (2) of the vehicle (3).

7. Method according to claim 5 or 6, characterised in that several transmitting beacons are used, each with a restricted range, but together covering an entire area, and in that navigation data (5) are transmitted regarding the immediate surrounding area of every transmitting beacon concerned, containing many details of the immediate surrounding area of the transmitting beacon concerned, whereas less details are transmitted with relation to the broader area.

8. Method according to any of claims 2 to 7, characterised in that selected contextual information is transmitted according to the invention, whereby it contains more details for those zones where the chance that the route will have to be recalculated is greater than for the other zones.

9. Method according to claim 8, characterised in that the contextual information contains at least more details about the starting point and end point of the precalculated route, as well as more details regarding busy traffic points, whereas it contains less details regarding the intermediate parts of the route.

10. Method according to any of the preceding claims, characterised in that the navigation data (5) which are obtained via the wireless connection and which make it possible to carry out the above-mentioned navigational calculations in the telematics device (2) in the vehicle (3), in particular the above-mentioned contextual information, are transmitted in the form of an algorithm.

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11. Method according to any of the preceding claims, characterised in that current information is taken into account.

5 12. Method according to claim 11, characterised in that the current traffic information is at least implied in the calculation of the navigation data (5) which have to make it possible to carry out navigational calculations in the vehicle (3) itself, and is in particular implied in the  
10 determination of the above-mentioned contextual information.

13. Method according to claim 11 or 12, characterised in that the current traffic information is transmitted  
15 directly to the telematics device (2) in the vehicle (3), whereby this telematics device (2) recalculates the route to be followed as a function thereof.

14. Method according to any of the preceding claims,  
20 characterised in that the above-mentioned navigation data (5), in particular the above-mentioned algorithm, are compressed.

15. Method according to any of the preceding claims,  
25 characterised in that the vector data of the above-mentioned navigation data (5) are compressed.

16. Method according to any of the preceding claims,  
characterised in that the above-mentioned navigation data  
30 (5) are transmitted as a code executed in JAVA.

17. Method according to any of the preceding claims, characterised in that the navigation data (5) which make it possible to make a calculation on board of the vehicle (3)

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are automatically regularly updated as a function of the position of the vehicle (3).

18. Device for providing navigation data to a vehicle, in particular a road vehicle, applying the method according to any of the preceding claims, characterised in that it mainly consists of a device (4) for among others providing navigation data (5) in a wireless manner, whereby this device (4) is equipped with means (12) which can generate and transmit contextual information, which makes it possible to make navigational calculations in the vehicle (3) itself; a telematics device (2) which is present in the vehicle (3) having at least means (8) for the wireless reception of the above-mentioned navigation data (5), means (9) for putting in data so as to ask for a route, means (10) for the processing of navigation data (5) having an arithmetic unit (14) for calculating or recalculating a requested route on the basis of the above-mentioned contextual information, and means (11) for representing the navigation data which are important to the driver; and means (7) to determine the position of the vehicle (3) which work in conjunction with the telematics device (2) or which are part thereof.

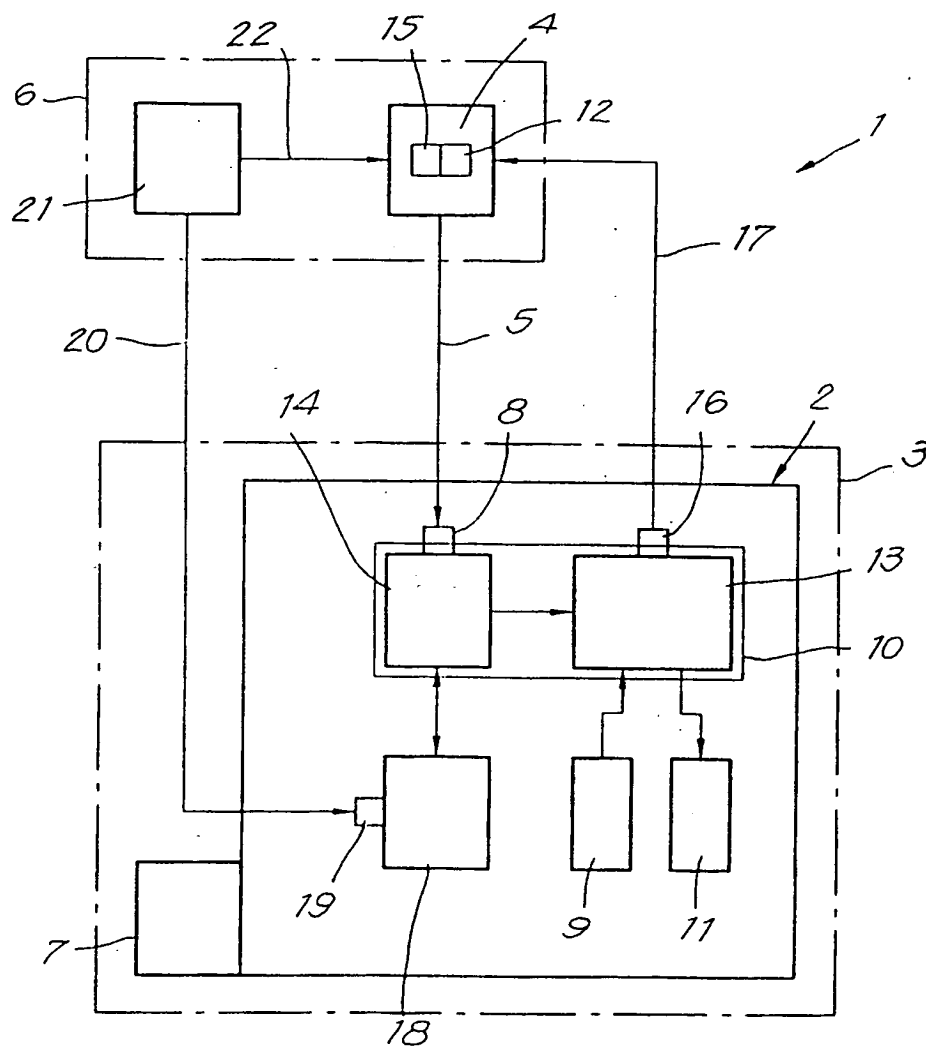
19. Device according to claim 18, characterised in that the device (4) for making the navigation data (5) available in a wireless manner contains means (15) which can calculate a route beforehand, so as to transmit the precalculated route together with contextual information to the vehicle (3).

20. Device according to claim 18 or 19, characterised in that the means (10) for processing the navigation data (5) also have a unit (18) for processing traffic information, whereby this unit (18) works in conjunction with the above-mentioned arithmetic unit (14).

21. Device according to claim 20, characterised in that it contains means (21) for transmitting traffic information, and in that the above-mentioned unit (18) for processing  
5 the traffic information contains at least a filter unit which exclusively transmits the relevant information to the above-mentioned arithmetic unit (14).

22. Device according to any of claims 18 to 21,  
10 characterised in that the means for determining the position of the vehicle (3) consist of a GPS.

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*Fig. 1*

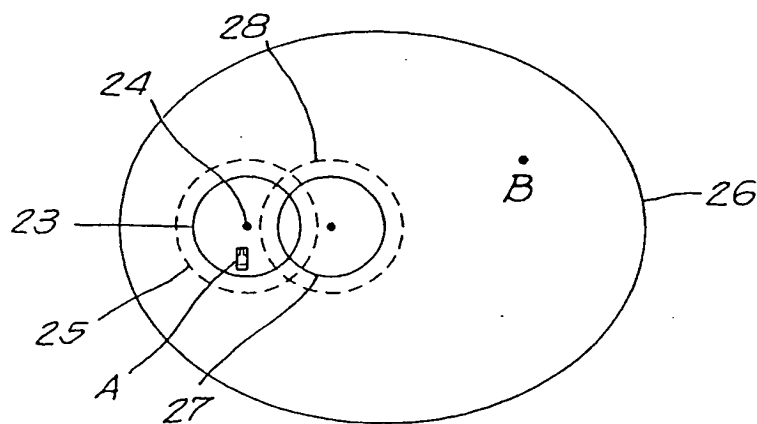


Fig. 2

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/BE 00/00009

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 G08G1/0968

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G08G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 954 958 A (SAVAGE CHARLES ET AL) 4 September 1990 (1990-09-04) column 5, line 65 -column 11, line 22	1,2
A	—	3-22
X	WO 96 11380 A (MANNESMANN AG ;WAIZMANN GERD (DE); GARTHWAITE PAUL (DE); ALBRECHT) 18 April 1996 (1996-04-18) figure 1	1,2
A	—	3-22
A	EP 0 803 852 A (MANNESMANN VDO AG) 29 October 1997 (1997-10-29) the whole document	1-22
	— -/--	

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☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

16 May 2000

Date of mailing of the international search report

06/06/2000

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# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/BE 00/00009

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